# PARTICLE SIZE AND MULTI-ELEMENTAL ANALYSES OF BULK DUST SAMPLES FROM A PAINT MANUFACTURING PLANT

By

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# ABSTRAK

Habuk cat dari sebuah kilang membuat cat dikumpulkan daripada dua alat pemungut habuk. Habuk itu dijanakan secara berasingan daripada proses pembuatan cat berasaskan pelarut dan proses pembuatan cat berasaskan air. Garispusat saiz zarah min dan taburan garispusat saiz zarah sepanjang 12 minggu tempoh persampelan bagi setiap jenis habuk ditentukan dengan COULTER LS 230 Particle Size Analyzer. Lengkungan taburan kumulatif mingguan bagi garispusat saiz zarah untuk setiap jenis habuk juga dibandingkan. Garispusat zarah min berlandaskan isipadu bagi habuk cat berasaskan pelarut didapati bernilai 0.941± 0.016 μm manakala habuk cat berasaskan air didapati bernilai 8.185± 0.201 μm. Perbezaan nilai-nilai ini mencadangkan bahawa habuk cat berasaskan air adalah 9 kali lebih kasar daripada habuk cat berasaskan pelarut.

Komposisi unsur-unsur sampel habuk juga ditentukan dengan ICP-AES yang berupaya menganalisa pelbagai unsur secara serentak. Komposisi kimia sampel habuk dikaji dengan merujuk khusus kepada empat logam berat yang terpilih: yakni, arsenik, kuprum, plumbum dan zink. Didapati bahawa kepekatan unsur-unsur tersebut adalah lebih tinggi dalam habuk cat berasaskan pelarut yang lebih halus daripada habuk cat berasaskan air yang lebih kasar. Ini seakan-akan mencadangkan suatu hubungan di antara keupayaan penyerapan zarah dan saiz zarah. Walaupun tiada berkesimpulan, penemuan mencadangkan kemungkinan peracunan tinggi dalam habuk cat berasaskan pelarut bila dibandingkan dengan habuk cat berasaskan air. Kepekatan min unsur-unsur yang terpilih itu dalam habuk cat berasaskan pelarut didapati bernilai 0.10± 0.02 mg/g

untuk arsenik, 1.55± 0.55 mg/g untuk kuprum, 15.68± 11.78 mg/g untuk plumbum dan 30.46± 10.58 mg/g untuk zink. Kepekatan min dalam habuk cat berasaskan air didapati bernilai 20.65± 6.11 μg/g untuk arsenik, 9.14± 14.65 μg/g untuk kuprum, 57.46± 22.42 μg/g untuk plumbum dan 1660± 1260 μg/g untuk zink. Plumbum dan zink adalah unsur-unsur terutama dalam habuk cat berasaskan pelarut manakala zink adalah unsur terutama dalam habuk cat berasaskan air.

# ABSTRACT

Paint dust from a paint manufacturing plant were collected from two dust-collecting hoppers. The dust were generated individually from the solvent-based and the water-based paint manufacturing processes. The mean particle size diameter and the particle size diameter distribution over 12-week sampling period of each of the dust type were determined using a COULTER LS 230 Particle Size Analyzer. The weekly cumulative distribution curves of particle size diameter for each dust type were also compared. The volume weighted mean particle diameter for solvent-based paint dust was found to be 0.941±0.016 μm while that for the water-based paint dust was found to be 8.185±0.201 μm. This difference in value suggests that the latter was about 9 times coarser than the former dust type.

The elemental composition of the dust samples was also determined using the inductively coupled plasma-atomic emission spectrometry (ICP-AES) which is capable of multi-elemental analysis. The chemical composition of the dust samples was studied with particular reference to four selected heavy metals: namely, arsenic, copper, lead, and zinc. It was found that the concentrations of these elements were considerably much higher in the finer solvent-based paint dust than in the coarser water-based paint dust. This appears to suggest a relationship between the absorption capacity of particle and particle size. Although inconclusive, the findings suggest the possible higher toxicity of solvent-based paint dust as compared to that of water-based paint dust.The mean concentrations of the selected elements in solvent-based paint dust was found to be 0.10±0.02 mg/g for arsenic, 1.55±0.55 mg/g for copper, 15.68±11.78 mg/g for lead and

30.46±10.58 mg/g for zinc. The mean elemental concentrations in water-based paint dust was found to be 20.65±6.11 μg/g for arsenic, 9.14±14.65 μg/g for copper, 57.46±22.42 μg/g for lead and 1660±1260 μg/g for zinc. Lead and zinc are the predominant elements in the solvent-based paint dust whilst zinc is the predominant element in the water-based paint dust.

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$$d_{lc} = \text{antilog}\left(\frac{\log_{\text{lower edge}} + \log_{\text{upper edge}}}{2}\right)$$



$$D(p,q) = \left[\frac{\sum n_c d_{lc}^{\,p}}{\sum n_c d_{lc}^{\,q}}\right]^{1/p-q}$$



$$D(4,3) = \frac{\sum n_c d_{lc}^{\,4}}{\sum n_c d_{lc}^{\,3}}$$